

# NEW SPECIES OF ORIBATULIDAE (ACARIDA: CRYPTOSTIGMATA: PLANOFISSURAE) FROM SOUTH AUSTRALIAN SOILS, WITH A REVIEW OF SUBFAMILIES AND AUSTRALIAN RECORDS

D. C. LEE

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Oribatulid mites from Australian soils are considered with comments on the subfamilies. Three new species, a new genus and a new species record are established for two subfamilies in South Australia as follows: Oribatulinae – *Oribatula runciata* sp. nov., *Zygoribatula cycloporosa* sp. nov., *Z. magna* Ramsay; Pseudoppiinae – *Ausoribula quagesetosa* gen. nov., sp. nov. Of the nine florally diverse South Australian sites sampled, the new species and records are from only three sites with either a semi-arid, mallee-heath or pasture habitat. A key is provided for all six oribatulid species known from Australia. *Oribatula caudata* Berlese, 1910 is newly regarded as a synonym of *Seltnickia caudata* (Michael, 1908).

D. C. Lee, South Australian Museum, North Terrace, Adelaide, South Australia 5000. Manuscript received 13th September 1991.

This is a further part of an ongoing study of sarcoptiform mites in South Australian soils, sampled from nine florally diverse sites, and for which an introduction to the relevant work on the advanced oribate mites (Planofissurae) has been published (Lee 1987). The classification of the Oribatulidae followed was initially that of Balogh & Balogh (1984). This was changed after the description of species of a number of oripodoid genera from or relevant to the Australian fauna (Lee 1987; Lee & Birchby 1989, 1991a, 1991b) led to the higher classification of the Oripodoidea, and so the included Oribatulidae, being modified (Lee 1991). The present paper outlines and adds to these changes to the oribatulid classification and also deals with three genera, from two subfamilies, from which three new species are described. A key is provided to distinguish all six oribatulid species known from Australia, completing the consideration of the Oribatulidae within this study.

The mites studied have either been deposited in the South Australian Museum (SAMA), the Field Museum, Chicago (FMNH), the Natural History Museum, London (BMNH), or the New Zealand Arthropod Collection, D.S.I.R. Auckland (NZAC), whilst the holotype of *Zygoribatula longiporosa* Hammer, 1953 has been returned to the Queensland Museum (QM). The morphological notational system follows Lee (1987), the somal chaetotaxy of which is summarised in Figs 1 and 2, with the total setae present in each file (*e.g.* 6Z) indicated by number coming first, whilst a particular seta (*e.g.* Z6) would have the number last. The abbreviations for zoogeographical regions follow Lee (1970, fig. 427). The descriptions of eggs refer to them whilst still within the female soma. All material was examined using a Normarski interference contrast device. Measurements are in micrometres ( $\mu\text{m}$ ) and were made using an eyepiece micrometer at  $\times 250$  magnification.

## SYSTEMATICS

### Family ORIBATULIDAE Thor

Oribatulidae Thor, 1929: 184  
Oribatulidae: Grandjean, 1954: 440  
Oribatulidae: Coetzer, 1968: 15  
Oribatulidae: Balogh & Balogh, 1984: 270

Nominotype: *Oribatula* Berlese, 1896

#### Diagnosis

Oripodoidea. Hysteronotal foramina multiporose. Dorsejugal furrow present or absent. Lamella (between setae z1-z2) and translamella (between setae z1-z1), if present, either lamellate, costate or lineate. Other proteronotal ridges (sublamella, prelamella, tatorium or subtatorium) costate or lineate. Hysteronotum without pteromorph, although may have humeral process, and limbus usually inconspicuous. Ventrosejugal apodeme either complete or partial with mid-sternal gap. Preanal sclerite with breadth of lever half or less that of refractile cup-shaped caput. Femur I, and usually II, with medium-size stalk (length about  $2\times$  pedestal diameter), so that caput well separated from pedestal. Femur I and II each with 5 setae, seta  $\nu 2$  present. Tarsi I and II broad proximally (greater than  $0.75\times$  broadest part). Pretarsus with three claws. Larva with seta on anal shield, and solenidion on palp tarsus does not form 'corne double' with dorsal plasmic seta.

#### Remarks

The Oribatulidae were restricted when some genera were removed to establish Schelorbitidae (Grandjean, 1933), but this was not generally accepted until a revision of the Oripodoidea (as Oribatuloidea) by Balogh & Balogh (1984), where Schelorbitidae was

mistakenly referred to as a new family. In Balogh & Balogh's revision, the Oribatulidae were subdivided into four subfamilies, mainly on the basis of the number of genital setae. A subfamily that they ignored, Pseudoppiinae Mahunka, 1975, has since been redefined by Lee (1987) and, with a new subfamily, Fovoribatulinae Lee & Birchby, 1991a, extended the Oribatulidae to six subfamilies. Four of these subfamilies (Capilloppiinae, Crassoribatulinae, Fovoribatulinae and Sellnickiinae) have since been excluded from the Oribatulidae and they are considered briefly here.

The Fovoribatulinae Lee & Birchby, 1991a, when established, included new genera, *Brassiella* Balogh, 1970 (ex Fenicheliidae), *Reticuloppia* Balogh & Mahunka, 1966b (ex Oribatulinae) and *Romanobates* Feider, Vasiliu & Calugar, 1970 (ex Capilloppiinae). The subfamily was recognised by the absence of a seta (*av*2) on femur II. Later, this character state was considered as diagnostic of the primitive Crassoribatulid-complex (Lee 1991), many members of which are similar to the oribatulid species. Both Fovoribatulinae and Crassoribatulinae Balogh & Balogh, 1984 (ex Oribatulidae) were grouped in this Crassoribatulid-complex.

Both Sellnickiinae Grandjean, 1960 (mistakenly referred to as a new subfamily by Balogh & Balogh, 1984) and Capilloppiinae Balogh & Balogh, 1984 were excluded from the Oribatulidae to be included in either the Sellnickiid-complex or the Capilloppiidae (Mochlozetid-complex) by Lee (1991). This was mainly based on the shape of their preanal sclerites, but it has since been established (see following remarks) that the Capilloppiidae have a leg chaetotaxy and preanal sclerite as for members of the Crassoribatulid-complex and they are placed as a subfamily within the Crassoribatulidae.

The examination of the types of further oribatulid-like taxa, since the above changes were made (Lee 1991), has established that some of them lack seta *v*2 on femur II and they are, therefore, also here grouped in the Crassoribatulidae-complex. For these taxa, the setation of femur I and II is as follows: *Nesozetes rostropterus* Hammer, 1971 – femur I 1,2/1,0, femur II 1,2/1,0; *Capilloppia capillata* Balogh & Mahunka, 1966a – femur I 1,2/1,0, femur II, 1,2/1,0; *Lunoribatula polygonata* Mahunka, 1982 – femur I 0,2/1,0, femur II 0,2/1,0. Also the preanal sclerites of the types of *Capilloppia capillata* have a narrow lever and a refractile cup-shaped caput. Therefore, the new placings of these taxa, which have been grouped within or near to the Oribatulidae, are now within the Crassoribatulid-complex adding two subfamilies to that complex as follows: the Nesozetinae Balogh & Balogh, 1984 are grouped in the Lamellareidae Balogh, 1972 and the Capilloppiinae Balogh & Balogh, 1984, including *Lunoribatula*, are in the Crassoribatulidae Balogh & Balogh, 1984.

## KEY TO AUSTRALIAN ORIBATULID SPECIES (ADULTS)

- 1 – Ventrosejugal apodemes continuous across midsternal line.....Oribatulinae 2
  - Ventrosejugal apodemes do not merge across midsternal line.....Pseudoppiinae 5
- 2 – Translamella absent. *Oribatula runcinata* sp. nov.
  - Translamella present.....*Zygoribatula* 3
- 3 – Lamella and translamella broad, cuspis large (length about 5× diameter of setal base to *z*1). Behind interlamella seta (*j*2), ridge runs back to dorsosejugal furrow. First hysteronotal foramina (*F*3) oval (length 2× breadth), shorter than seta *ZZ*.....*Zygoribatula magna* Ramsay
  - Lamella and translamella narrow, cuspis small (length about 2× diameter of setal base to *z*1).....4
- 4 – Behind interlamella seta (*j*2), ridge runs laterally to sensory seta (*z*2). First hysteronotal foramina (*F*3) spherical (length subequal to breadth). Head of sensory seta (*z*2) globular.....*Zygoribatula cycloporosa* sp. nov.
  - Interlamellar seta (*j*2) without associated ridges. First hysteronotal foramina (*F*3) elongate (length about 10× breadth). Head of sensory seta (*z*2) pyriform....*Zygoribatula longiporosa* Hammer
- 5 – Hysteronotum with 15 pairs of setae (6*J*, 6*Z*, 3*S*). Genital shield with two pairs of setae (2*JZg*)....*Constrictobates lineolatus* Balogh & Mahunka
  - Hysteronotum with 10 pairs of setae (2*J*, 6*Z*, 2*S*). Genital shield with four pairs of setae (4*JZg*)....*Ausoribula quagesetosa* sp. nov.

### Subfamily ORIBATULINAE Thor

#### Diagnosis

Oribatulidae. Ventrosejugal apodemes continuous across midsternal line. Hysteronotum oval, sometimes with humeral process, usually with 14 pairs of setae (exceptions: 10 pairs on *Paraphauloppia* and *Jornadia*, 12 or 13 pairs on some *Eporibatula*, *Oribatula* and *Zygoribatula* species), sejugal furrow not extending anterior to bothridium (around seta *z*2), always present across mid-line. Four pairs of multiporose hysteronotal foramina usually present (exception: three pairs on *Paraphauloppia triforamina*). Genital shield usually with four pairs of setae (exception: five pairs on *Jornadia*). Legs long and slim.

#### Remarks

The Oribatulinae included 14 genera in the classification of Balogh & Balogh (1984). One of these genera, *Reticuloppia* Balogh & Mahunka, 1966b, has been transferred (Lee & Birchby 1991a) to Fovoribatulinae (Crassoribatulidae), whilst a number of genera are here grouped in Pseudoppiinae (see following text). This leaves only the following eight genera, of which the majority are cosmopolitan, in the Oribatulinae: *Eporibatula* Sellnick, 1928; *Jornadia* Wallwork & Weems, 1984; *Lucoppia* Berlese, 1908; *Oribatula* Berlese, 1896; *Paraphauloppia* Hammer,

1967; *Phauloppia* Berlese, 1908; *Spinoppia* Higgins & Woolley, 1966; *Zygoribatula* Berlese, 1916.

Other than the South Australian material collected in this study only the cosmopolitan *Zygoribatula* has been recorded from Australia (Hammer 1953). *Paraphauloppia*, previously known only from New Zealand and South America, has been collected in this study (Lee & Birchby 1991b). The current paper includes the first record of the cosmopolitan *Oribatula* from Australia.

## Genus *Oribatula* Berlese

*Oribatula* Berlese, 1896: LXXIX,12. Type-species (original designation): '*Oribatula tibialis*' (= *Notaspis tibialis* Nicolet, 1855; Berlese, 1895: LXXVII,5).

*Oribatula*: Hammen, 1952: 80.

*Oribatula*: Travé, 1961: 313.

*Oribatula*: Coetzer, 1968: 55.

Type-species: *Oribatula tibialis* (Nicolet, 1855)

### Diagnosis

Oribatulinae. Twelve, thirteen or fourteen pairs of short, smooth or weakly ciliate hysteronotal setae. Humeral setae (Z1, S1) similar in shape and size to other hysteronotal setae (rarely Z1 stouter, but still subequal in length). Proteronotum without translamella, lamella at least lamellate anteriorly (never just costate or lineate), in subparallel pair, medium size or long, distance between lamellar seta z1 and dorsosejugal furrow greater than 1.5× distance between interlamellar seta j2 and bothridium of sensory seta z2. Genital shield with four pairs of setae.

### Distribution

Regarded as possibly cosmopolitan, but all records before this paper appear to be from only the Holarctic or Ethiopian region. Both saxicolous and arboreal on epiphytes (Travé 1961), in Europe found on moss on northern slopes of mountains, and not very sensitive to drought (Hammen 1952), also found in marshes and pasture sod (Krantz 1978). This single record from Australia is from the semi-arid region.

### Remarks

*Oribatula* is very similar to some other oribatulid genera. It only differs from *Zygoribatula* in that it lacks a translamella as commented on later in the 'Remarks' on that genus. It is also very like *Phauloppia*, which differs in having a lineate lamella, seta z1 closer to j2 than j1 and seta Z1 closer to S1 than J2.

*Oribatula caudata* Berlese, 1910 from *Citrus deliciosa*, New South Wales, is here combined with *Sellnickia* and is also newly regarded as a synonym of its senior homonym, *Sellnickia caudata* (Michael, 1908). *S. caudata* was originally described from New

Zealand, but was redescribed in detail by Grandjean (1958) from the leaves of lemon trees in Queensland. The similarity in appearance, including the presence of a rather long conical posterior process on the hysteronotum of an *Oribatula*-like mite, is considered sufficient to group *Oribatula caudata* in *Sellnickia*.

*Oribatula* includes the following 15 species and one subspecies (note — many species with 10 pairs of hysteronotal setae were transferred to *Paraphauloppia* by Coetzer, 1968): *O. acuminata* Wallwork, 1964; *O. exsudans* Travé, 1961; *O. florens* Berlese, 1908; *O. incompleta* Mahunka, 1987; *O. interrupta* (Willmann, 1939); *O. interrupta major* (Mihelcic, 1963); *O. pallida* Banks, 1906; *O. pannonica* Willmann, 1949 (see Travé, 1961); *O. parisi* Travé, 1961; *O. sakamorii* Aoki, 1970; *O. saxicola* (Kunst, 1959); *O. tibialis* Nicolet, 1855; *O. torrijosi* Subias, Ruiz & Kahwash, 1990; *O. variabilis* Berlese, 1908; *O. venusta* Berlese, 1908; *O. vera* (Bulanova-Zachvatkina, 1967).

*Oribatula runcinata* sp. nov.  
(Figs 1-3)

### Female

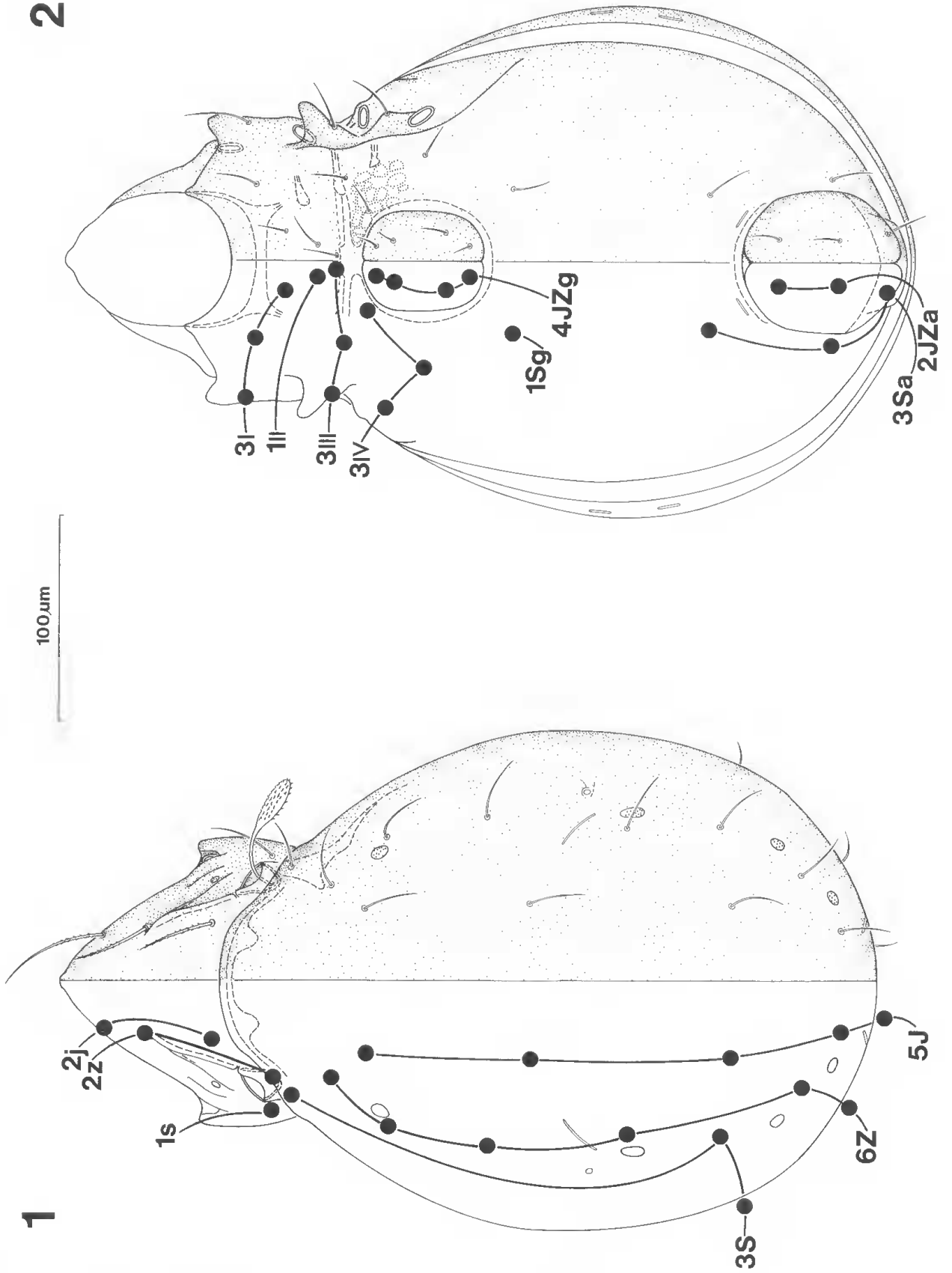
Dorsal profile of hysteronotum ovoid, mid-brown, surface glabrous, without reliculations. Coxite area with faint reticulations. Idiosomal length 397 (n = 15, 357-437). Leg lengths (femur-tarsus for idiosomal length 400): I-222, II-182, III-172, IV-220. Tibial maximum heights (for 400): I-20.5, II-15.5, III-13, IV-14.

Proteronotum with slim lamella, mainly costate, lamellate anteriorly, but not bearing seta z1 (lies on flat proteronotal surface), and costate sublamella. Setae j1, j2 and z1 stout, and noticeably ciliate, j1 longest. Sensory seta (z2) clavate, exposed stalk subequal in length to head covered with fine cilia.

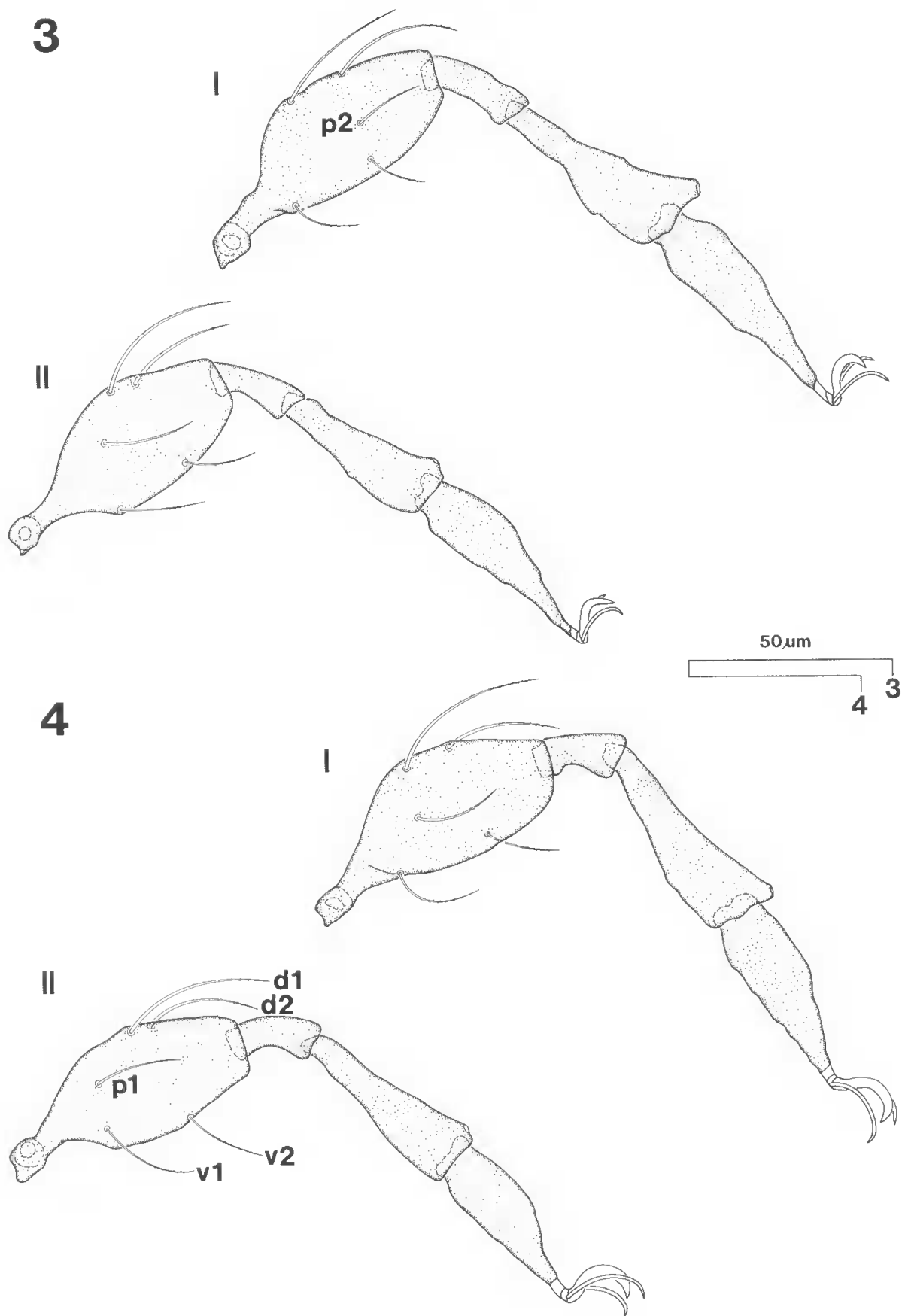
Hysteronotal setae short, fine, setose and subequal in length. Multiporose foramina small, F3 length less than 0.33× distance between setae Z1-Z2, anterior two pairs (F3, F4) larger than posterior pairs (F5, F6), all four pairs round or weakly oval. Slit shaped pore hf3 sloping outwards towards posterior.

Podosternum with circumpedal ridge merged with rest of subpedal ridge, distinct from and ventral to discidium and pedotectum II, absent below pedotectum I. Discidium forms costate ridge. Setae vary in length, lateral setae (I3, III3, IV3) similar to hysteronotal setae, other coxite setae smaller, smallest setae on genital shields.

Opisthosternum with outer file (Sa) of setae longer than coxite setae and setae on anal shield (Jza) subequal in length to smallest coxite setae. Slit-like pore Saf nearly transverse, more than 45° from longitudinal axis. Eggs subcylindrical with convex ends, 181 × 90 (mean of 7 horizontally aligned eggs, 46% of mean female length), smooth exochorion. Number of eggs



FIGURES 1 AND 2. *Oribatula runcinata*, female soma. 1, notum; 2, idiosternum



FIGURES 3 AND 4. Right legs I and II, femur-pretarsi, posterior aspect. 3, *Oribatula runcinata*; 4, *Zygoribatula cycloporosa*. All setae on femurs I and II illustrated, *d* = dorsal, *p* = posterior, *v* = ventral.

in female (number of females) as follows: none (2), one (1), two (4), three (5), four (2), six (1).

Legs long (mean femur-tarsus: 50% soma), slim (mean maximum tibial height: 26% of mean length). All femora and trochanters III and IV with dorsal adaxial porose areas and vertical adaxial ridges.

#### Male

As female except soma smaller, idiosomal length 359 (n = 23, 332-380).

#### Material examined

Holotype: ♀ (N19901033), soil, litter, moss and other low growth plants under bladder saltbush (*Atriplex vesicaria*) amongst sparse false sandalwood (*Myoporum platycarpum*), Koonamore Vegetation Reserve (32°07'S, 139°21'E), 27.vi.1974.

Paratypes: 11 ♀♀ (N19901034-N19901044); 17 ♂♂ (N19901045-N19901061); 1 ♀, 2 ♂♂ BMNH; 1 ♀, 2 ♂♂ FMNH; 1 ♀, 2 ♂♂ NZAC; same data as holotype.

#### Distribution

Australia (Aa), South Australia. Semi-arid low shrubland (Koonamore Vegetation Reserve), Lake Eyre Basin, 15 ♀♀, 23 ♂♂ / 5 of 8 × 25 cm<sup>2</sup>.

#### Remarks

The specific name *runcinata* is derived from the Latin 'runcinare' to 'smooth' and refers to the unsculptured notal surface. The slim lamellae distinguish *O. runcinata* from other species of *Oribatula*, and although *O. pannonica* Willmann, 1949 also has slim lamellae they are extensive enough to carry seta z1. The large sensory seta (z2) also distinguishes it, *O. vera* (Bulanova-Zachvatkina, 1967) having the next largest seta z2.

### Genus *Zygoribatula* Berlese

*Zygoribatula* Berlese, 1916: 317. Type-species (original designation): '*Oribates connexus* Berl.'

*Neoribatula* Ewing, 1917: 128.

*Zygoribatula*: Travé, 1961: 328.

*Zygoribatula*: Coetzer, 1968: 92.

Type-species: *Zygoribatula connexa* (Berlese, 1904)

#### Diagnosis

Oribatulinae. Thirteen or fourteen pairs of short to medium, smooth or weakly ciliate hysteronotal setae. Humeral setae (Z1, S1) similar in shape and size to other hysteronotal setae (rarely Z1 stouter and more ciliate, but still subequal in length or smaller). Proteronotum with lamellate translamella and lamella, subparallel pair of lamellae, medium size to long, distance between

lamellar seta (z1) and dorsosejugal furrow greater than 1.5 × distance between interlamellar seta j2 and bothridium of sensory seta z2. Genital shield with four pairs of setae.

#### Distribution

Cosmopolitan. Both saxicolous and arboreal, in moss, or on sap or bark, also hemiedaphic in many different types of soil from sand to clay, with or without humus and even in the intertidal zone. Three species are now known from Australia. *Zygoribatula longiporosa* Hammer, 1953 was recorded from pasture in southern Queensland, *Z. magna* Ramsay, 1966, originally described from pasture near Wellington, New Zealand, is now recorded from pasture near Adelaide, South Australia, and *Z. cycloporosa* sp. nov. was collected at the Mallee-heath site under *Banksia* shrubs.

#### Remarks

*Zygoribatula* is very similar to *Oribatula*, as discussed by Travé (1961), who decided to retain the genus 'pour des raisons de commodité', implying that it may not be valid. The only character distinguishing *Zygoribatula* from *Oribatula* is the presence of a complete lamellate translamella between setae z1-z1 and this may be discontinuous in some specimens of a species (Luxton, 1987). *Zygoribatula* is much more species-rich than *Oribatula*. Fritz (1982) lists 85 species, but two of these (*Z. interrupta* and *Z. saxicola*) are here grouped in *Oribatula* as by Travé (1961). *Zygoribatula lenticulata* Minguez & Subias, 1986, because of its similarity to *Romanobates* in the Crassoribatulidae, had the chaetotaxy of two of its male paratypes examined and for femur I it was 1,2/2,1 and for femur II it was 1,2/2,1, as for all oribatulids, and not fewer setae as for Crassoribatulidae. *Zygoribatula dactilaris* Subias, Ruiz & Kahwash, 1990 is newly combined with *Phauloppiella*, as commented on in the following remarks on Pseudoppiinae. A further three species are included in *Zygoribatula* as follows: *Z. baloghi* Mahunka, 1986, *Z. endroedyi* Mahunka, 1986 and *Z. knighti* Luxton, 1987.

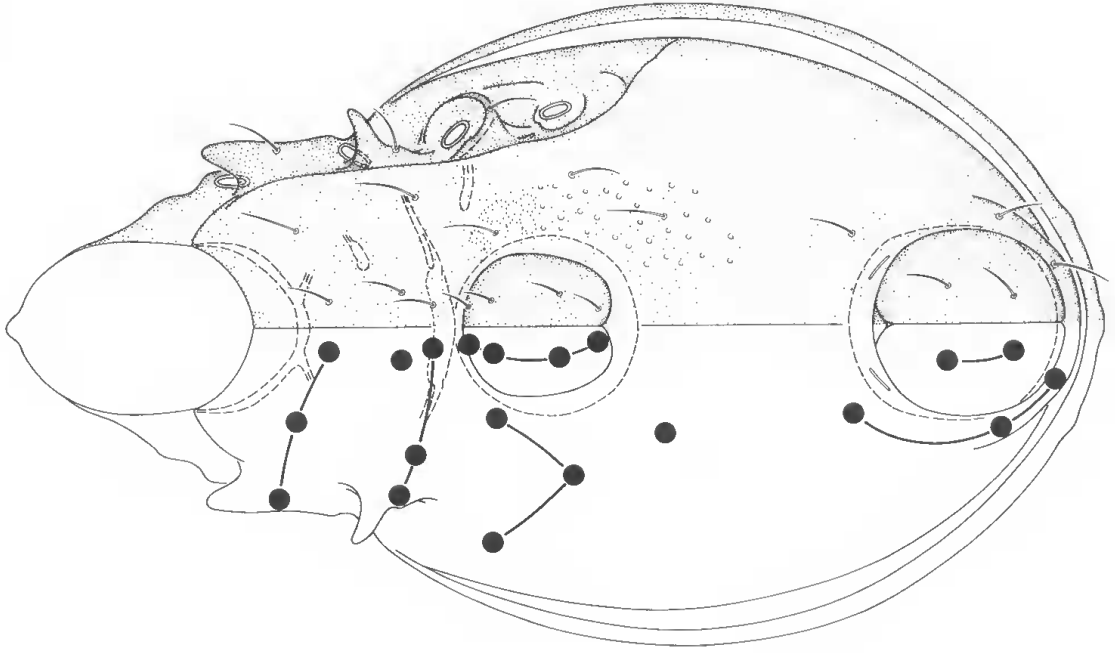
*Zygoribatula cycloporosa* sp. nov.  
(Figs 4-6)

#### Female

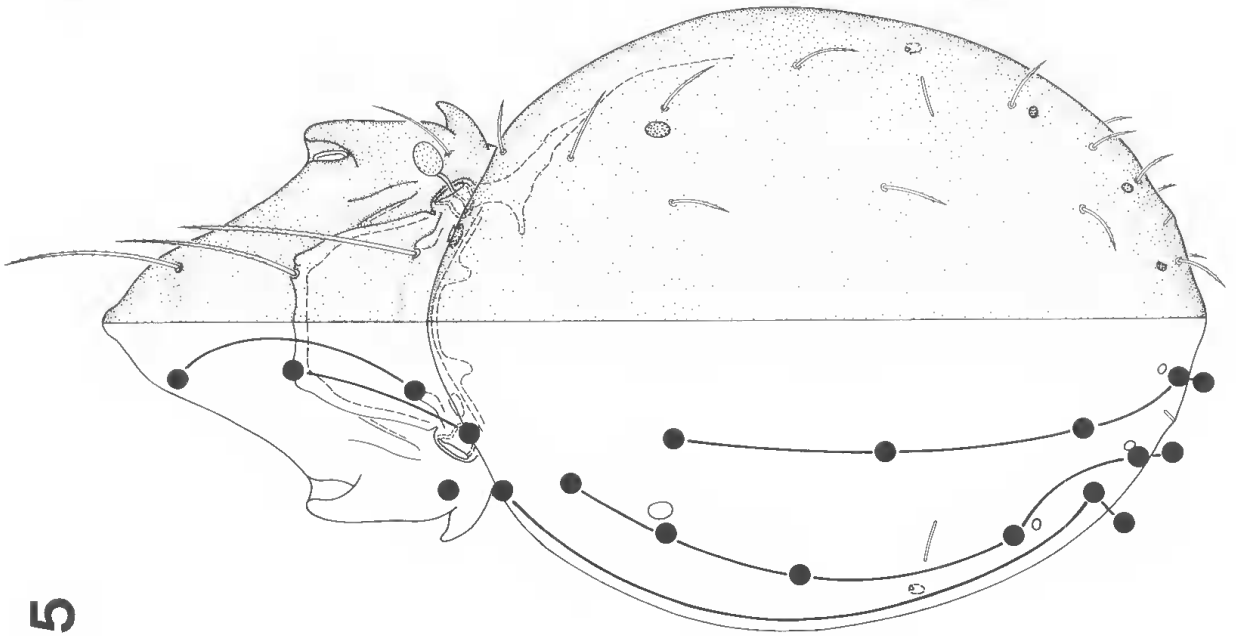
Dorsal profile of hysteronotum ovoid, light-brown, surface sparsely punctate. Coxite area with reticulations. Idiosomal length 401 (n = 3, 388-409). Leg lengths (femur-tarsus for idiosomal length 388): I-244, II-208, III-203, IV-249. Tibial maximum heights (for 388): I-23, II-18, III-18, IV-18.

Proteronotum with lamellate lamella and translamella, and costate sublamella and costate ridge between setae j2-z2. Setae j1, j2 and z1 long, stout, and

6



100  $\mu$ m



5

FIGURES 5 AND 6. *Zyoribatula cycloporosa*, female soma. 5, notum; 6, idiosternum. For setal notation see Figs 1 and 2.

noticeably ciliate,  $j2$  longest. Sensory seta ( $z2$ ) medium size (length  $0.33 \times$  distance between setae  $z1-z2$ ), capitate, exposed stalk subequal in length to head covered with fine cilia.

Hysteronotal setae short, stout, setose (weakly ciliate) and subequal in length. Multiporose foramina small, diameter of  $F3$  less than  $0.33 \times$  distance between setae  $Z1-Z2$ , anterior pair ( $F3$ ) conspicuously larger than posterior pairs ( $F4$ ,  $F5$ ,  $F6$ ), all four pairs round. On right side of one female, foramina  $F5$  and  $F6$  replaced by single pair in intermediate position. Slit shaped pore  $hf3$  nearly transverse, sloping acutely inwards towards posterior.

Podosternum with circumpedal ridge merged with rest of subpedal ridge, distinct from and ventral to discidium and pedotectum, present (may be faint) below pedotectum I. Discidium forms semicircular costate ridge around posterior margin of acetabulum for leg III. Setae slim, setose, longer if positioned closer to lateral margin. Smallest setae on genital shields. On right side of one female, five genital setae.

Opisthosternum with setae in outer ( $Sa$ ) and inner ( $JZa$ ) files subequal in length. Slit-like pore  $Saf$  nearly transverse, more than  $45^\circ$  from longitudinal axis. Eggs subcylindrical with convex ends,  $168 \times 74$  (mean of 4 horizontally aligned eggs, 42% of mean somal length), smooth exochorion. Number of eggs in female (number of females) as follows: one (1), two (1), four (1).

Legs long (mean femur-tarsus: 57% soma), slim (mean maximum tibial height: 30% of mean length). All femora and trochanters III and IV with dorsal adaxial porose areas and, on femora III and IV, strong vertical ridges on adaxial surface, ventral to porose areas.

#### Male

Unknown.

#### Material examined

Holotype: ♀ (N19901280), sand, litter, under banksia shrubs (*Banksia ornata*) amongst other sclerophyllous shrubs and sparse brown stringybark mallee (*Eucalyptus baxteri*), Tamboore Homestead ( $35^\circ 57'S$ ,  $140^\circ 29'E$ ), 4.viii.1974.

Paratypes: 2 ♀♀ (N19901281, N19901282) same data as holotype.

#### Distribution

Australia (Aa), South Australia. Mallee-heath, tall open shrubland (Tamboore Homestead, near Mt Rescue Conservation Park), Murray-Darling basin, 3 ♀♀ / 1 of  $8 \times 25$  cm<sup>2</sup>.

#### Remarks

The prefix of the specific name *cycloporosa* is derived from the Greek 'kyklos' for 'circle' and refers to the hysteronotal multiporose foramina, which are

circular in outline. The only other species which have small, circular hysteronotal foramina and mainly costate lamellae and translamella (with limited lamellate parts and no distinct cuspis at apex of lamella) are *Z. frisiae* (Oudemans, 1900) from Netherlands, *Z. knighti* Luxton, 1987 from England and *Z. tenuelamellata* Miheleie, 1956 from Spain. *O. cycloporosa* is regarded as the most similar to *Z. knighti* because of the presence of a costate ridge between setae  $j2$  and  $z2$ . It differs from all three species in having long interlamellar setae ( $j2$ ) and an almost globular caput on setae  $z2$ .

#### *Zygoribatula longiporosa* Hammer (No figures)

*Zygoribatula longiporosa* Hammer, 1953: 236.

#### Female

Legs: Chaetotaxy of femur I 0,2/2,1; femur II 0,2/2,1.

#### Material examined

Syntypes, two females (W1854, W3569), pastures, lot 52-56 29, Yeerongpilly, Queensland, 14th May, 1952, F. H. S. Roberts.

#### Remarks

*Zygoribatula longiporosa* is the only species of Oribatulidae (as delineated here) recorded from Australia previous to this study. It was collected in large numbers from calf pastures in Queensland and examined for cysticercoids of the tapeworm *Moniezia benedeni*, between 1.8% and 5.7% being infested depending on the pasture sampled (Roberts, 1953). The types have been examined to establish the leg chaetotaxy, which has proved to be as found in the Oribatulidae and not reduced by at least the absence of a ventral seta on femur II as for the Fovoribatulinae. Proposals have been made that *Z. longiporosa* and *Z. tadrosi* Popp, 1960 from Egypt are synonymous with *Z. undulata* Berlese, 1916 from Italy (Pérez-Iñigo, 1974) and that *Z. longiporosa* is synonymous with *Z. heteroporosa* Wallwork, 1972 from California (Bhattacharya & Banerjee, 1980). These proposed synonymies are not accepted. The similarities between these species are the elongate first hysteronotal foramina ( $F3$ ) and the narrow lamella without a cuspis. On the other hand, even on the basis of the published descriptions, there are enough differences between the species (e.g. the size and shape of other hysteronotal foramina and the relative sizes of proteronotal setae) to suggest that they are valid taxa.

#### *Zygoribatula magna* Ramsay, 1966 (No figures)

#### Female

Dorsal profile of hysteronotum ovoid, dark-brown



colour, surface covered with fine striations. Lateral punctations and areolae with strong reticulations in coxite area. Idiosomal length 507 (n = 25, 468-535). Leg lengths (femur-tarsus for idiosomal length 516): I-266, II-245, III-242, IV-307. Tibial maximum heights (for 516): I-26, II-19, III-17, IV-19. Legs long (mean femur-tarsus: 51% soma), slim (mean maximum tibial height: 28% of mean length). Chaetotaxy of femur I 0,2/2,1; femur II 0,2/2,1. Dorsal adaxial porose areas and reticulate abaxial sculpturing on all femora and trochanters III and IV, strong vertical ridges on adaxial surface, ventral to porose areas on femora III and IV. Eggs subcylindrical with convex ends, 177 × 93 (mean of 4 horizontal aligned eggs, 35% of mean somal length), smooth exochorion. Number of eggs in female (number of females, total 25) as follows: none (23), two (1), three (1).

#### Male

As for female except soma smaller, idiosomal length 490 (n × 25, 463-516).

#### Material examined

Undesignated: 116 ♀♀ (N19901062-N19901177); 102 ♂♂ (N19901178-N19901279); 5 ♀♀, 5 ♂♂ BMNH; 5 ♀♀, 5 ♂♂ FMNH; 5 ♀♀, 5 ♂♂ NZAC; soil, bases of cultivated grass and plantain (*Plantago lanceolata*) in pasture of sheep, Glenthorne Research Station, O'Halloran Hill (35°02'S, 138°32'E), 12.vi.1974.

#### Distribution

Australia (Aa), South Australia. Cultivated pasture (Glenthorne Research Station), Southern Gulfs, 131 ♀♀, 117 ♂♂/ 6 of 8 × 25 cm<sup>2</sup>.

#### Remarks

*Zygoribatula magna* was first described from pastures near Wellington, New Zealand, where they were collected in samples with *Setobates scheloribatoides* (Ramsay, 1966) and 2-6% of the combined population of the two species were infested with tapeworm cysticercoids. No cysticercoids were found in the South Australian specimens.

#### Subfamily PSEUDOPPIINAE Mahunka

Pseudoppiinae Mahunka, 1975: 293

Constrictobatinae Balogh & Balogh, 1984: 280

Nominotype: *Pseudoppia* Mahunka, 1975

#### Diagnosis

Oribatulidae. Ventrosejugal apodemes do not meet across midsternal line. Hysteronotum pear-shaped with no humeral process, and between 10-15 pairs of setae, sejugal furrow extending anterior to bothridium (around seta z2), usually evanescent or absent across mid-line. Two, three or four pairs of multiporose hysteronotal foramina present. Genital shield usually with two or three pairs of setae (exceptions with 4JZg:

*Phauloppiella* and *Ausoribula*). Legs medium length and stout.

#### Remarks

The Pseudoppiinae Mahunka, 1975 was established with three genera. Balogh & Balogh (1984), in their comprehensive classification of the Oripodoidea (as Oribatuloidea), ignored Pseudoppiinae, leaving two of the included genera in Oribatulinae, and mistakenly omitting altogether the third original genus, *Symphauloppia* Balogh, 1972. Lee (1987) once again recognised the Pseudoppiinae and included a further two genera, *Constrictobates* from Fenichelidae and *Phauloppiella* from Oribatulinae. Later, Lee (1991) transferred a further five genera from either Capilloppiinae or Oribatulinae to Pseudoppiinae so that all the oribatulid genera with a gap between the ventrosejugal apodemes are included. One of these five genera, *Lunoribatula* Mahunka, 1982, has a reduced chaetotaxy on femora I and II as pointed out in previous remarks on Oribatulidae, and is now grouped in the Crassoribatulinae.

Attention is drawn here to the Liebstadiinae Balogh & Balogh, 1984, which are similar to the Pseudoppiinae, but are not regarded as allied to them, although this may change in future classifications of the Oripodoidea. The subfamily was established within the Protoribatidae, a family with multiporose foramina, a single pretarsal claw and usually with pteromorphs which are sometimes represented by only small humeral processes (as in Liebstadiinae), which is considered as representing a secondary loss of pteromorphs (Lee 1991). On the other hand, *Liebstadia* Oudemans 1906 was included in Scheloribatidae by Grandjean (1954) and still is by some acarologists (Wunderle, Beck & Woas 1990), supporting a phylogenetic model that it is primitive within the Scheloribatidae, most genera of which have sacculate hysteronotal foramina. Although the relationship of the Liebstadiinae to the Pseudoppiinae is uncertain, the adults of known taxa can easily be distinguished by the number of pretarsal claws.

The following nine genera are regarded as belonging to the cosmopolitan Pseudoppiinae: *Ausoribula* gen. nov., *Constrictobates* Balogh & Mahunka, 1966; *Diphauloppia* Balogh & Balogh, 1984; *Gertoubia* Coetzer, 1968; *Phauloppiella* Subias, 1977; *Pseudoppia* Pérez-Iñigo, 1966; *Senoribula* Mahunka, 1975; *Subphauloppia* Hammer, 1967; *Symphauloppia* Balogh, 1972. The only previous Australian records of the Pseudoppiinae have been of *Constrictobates*, originally from Western Australia and more recently from South Australia (Lee 1987). *Ausoribula*, established here, is also from South Australia.

Genus *Ausoribula* gen. nov.

Type-species: *Ausoribula quagesetosa* sp. nov.

*Diagnosis*

Pseudoppiinae. Hysteronotum with 11 pairs of setae (*J5*, *J6*, *Z1-Z6*, *S1*, *S5*, *S6*) and three pairs of foramina (*F3*, *F4*, *F5*). Dorsosejugal furrow not continuous across mid-dorsal line. Lamella present, mainly costate, only lineate in region of seta *z1*. Three prosternal apodeme bases (*I*, *II* and sejugal) present. Four pairs of setae on genital shields (*4JZg*) and two pairs of setae on anal shields (*2JZa*). Legs medium length or short (order of decreasing length: I, IV, II, III), tarsi I-III about twice genu length, tarsus IV about 3× genu length.

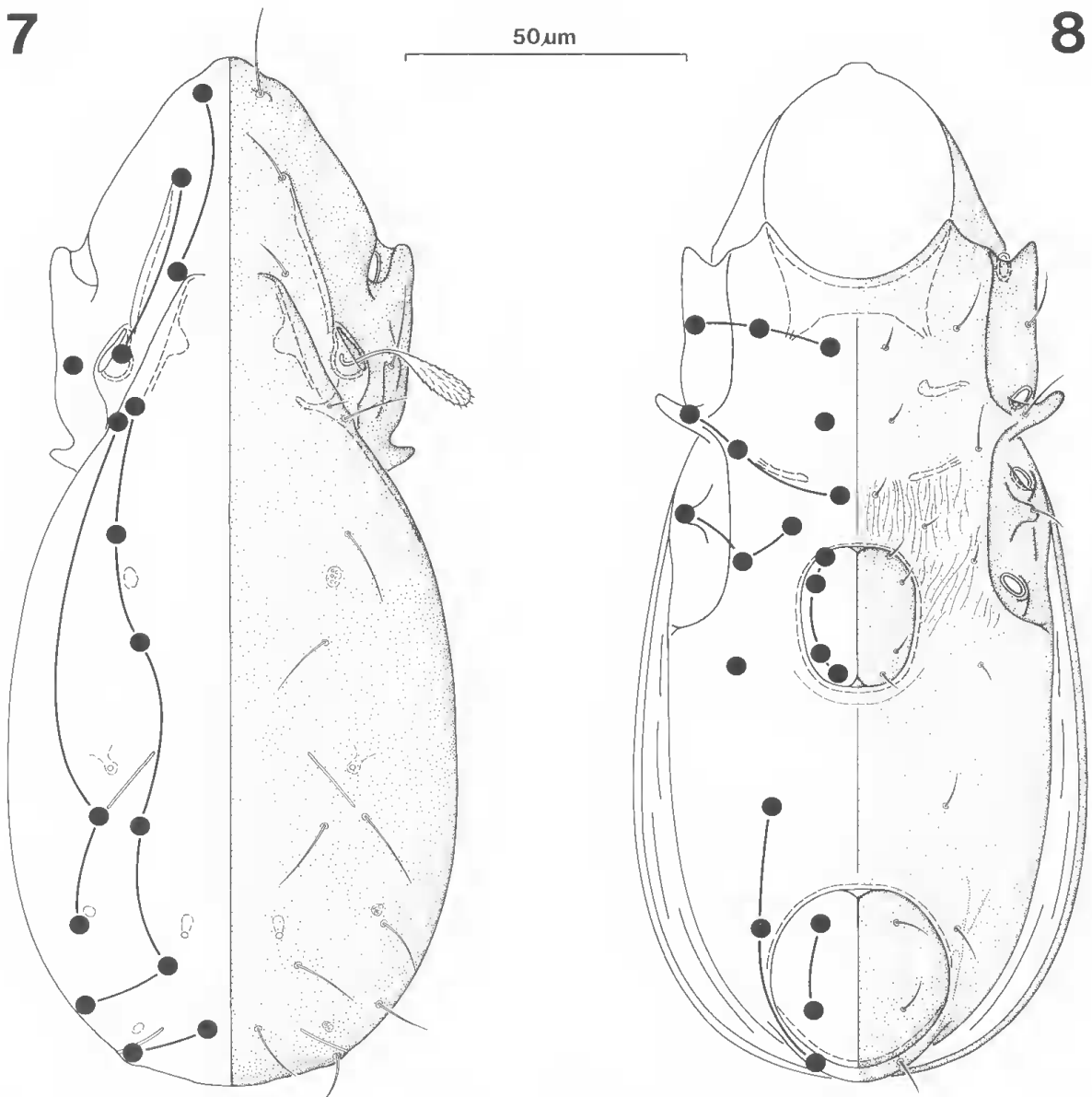
*Distribution*

Single species known only from South Australia.

*Remarks*

The prefix of *Ausoribula* refers to the genus being only known from Australia, while the rest of the name is a derivation from Oribatei (= Cryptostigmata), which Michael (1884) suggested may be derived either from the Greek words 'oros' (a mountain) and 'baino' (I go or walk) or from the proper noun 'Oribasus', Acteon's dog.

The relationships of *Ausoribula* within the Pseudoppiinae are uncertain. The recognition of pseudoppiine genera depends heavily on somal chaetotaxy, and *Ausoribula* has 14 pairs of hysteronotal setae like *Senoribula* and 4 pairs of genital setae like *Phauloppiella*. On the other hand, the presence of lamellae and only three pairs of hysteronotal foramina



FIGURES 7 AND 8. *Ausoribula quagesetosa*, female soma. 7, notum; 8, idiosternum. For setal notation see Figs 1 and 2.

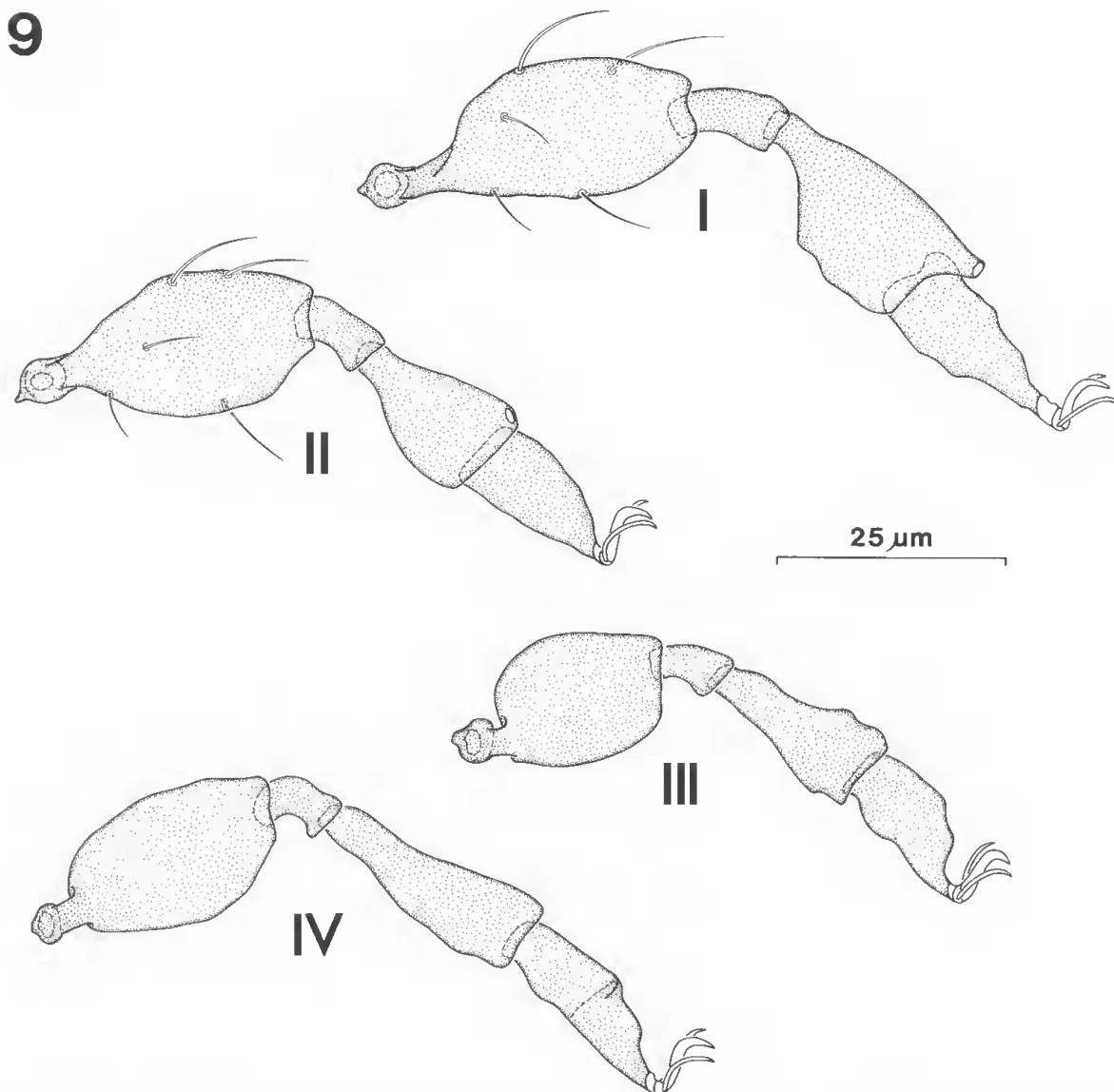


FIGURE 9. *Ausoribula quagesetosa*, female right legs I-IV, femur-pretarsi, posterior aspect. All setae on femurs I and II illustrated, *d* = dorsal, *p* = posterior, *v* = ventral.

are character states shared with the other Australian genus, *Constrictobates*, and may indicate that these two genera are closely allied.

*Ausoribula quagesetosa* sp. nov.  
(Figs 7-9)

#### Female

Dorsal profile of hysteronotum nearly parallel sided, straw-colour, surface smooth. Coxite area with fine striations. Idiosomal length 183 ( $n = 8$ , 177-191). Leg lengths (femur-tarsus for idiosomal length 182): I-95, II-77, III-68, IV-85. Tibial maximum heights (for 182): I-13, II-11.5, III-10, IV-10.

Proteronotum indented posteriorly by forward protrusion of hysteronotum. Weakly lamellate lamella; sublamella, prelamella and translamella absent. Setae *j*2 and *z*1 shorter than all other notal setae except

hysteronotal seta *Z*1. Sensory seta (*z*2) clavate, exposed stalk shorter than head, covered with fine cilia.

Hysteronotal seta mainly medium size, fine, setose and subequal in length, except for short seta *Z*1. Only three pairs of small, faint hysteronotal foramina. Unnamed pair of sacculate pores between setae *Z*5 and midline. Long slit shaped pore *hf*3 sloping outwards towards posterior.

Podosternum with circumpedal and sub-pedal ridge running close to base of legs, divided into two separate parts at pedotectum II. Discidium forms slim tubercle. Setae vary in length, with *I*2, *I*3, *II*3 longest and *IV*1 and *IV*2 shortest, similar to genital setae.

Opisthosternum with medium length setae compared to range in size of coxite setae. Slit-like pore *Saf* not located, although indistinct groove near genital orifice margin level with seta *Sa* may represent remnant. No eggs observed.

Legs medium length (mean femur-tarsus: 45% soma), stout (mean maximum tibial height: 51% of mean length). No dorsal porose areas, reticulate abaxial or ridged adaxial sculpturing on femora and trochanters, except that femur IV has strong vertical ridges on adaxial surface. Tarsus IV long (3× length of genu) with a vertical ridge halfway along its abaxial surface.

#### Male

As for female except soma smaller, idiosomal length 173 (n = 12, 167-177).

#### Material examined

Holotype: ♀ (N19901283), sand, litter, under banksia shrubs (*Banksia ornata*) amongst other sclerophyllous shrubs and sparse brown stringybark mallee (*Eucalyptus baxteri*), Tamboore Homestead (35°57'S, 140°29'E), 4.viii.1974.

Paratypes: 7 ♀♀ (N19901284-N19901290), 12 ♂♂ (N19901291-N19901302) same data as holotype.

#### Distribution

Australia (Aa), South Australia. Mallee-heath, tall open shrubland (Tamboore Homestead, near Mt Rescue Conservation Park), Murray-Darling basin, 7 ♀♀, 12 ♂♂/ 3 of 8 x 25 cm<sup>2</sup>.

#### Remarks

The prefix of the specific name *quagesetosa* is derived from abbreviations of the Latin 'quattuor' for 'four' and 'genitus' for 'be born' and refers to the four pairs of genital setae. It is the only species in the genus.

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